

The Spatial Effects of Labor Mobility Restrictions: Evidence from the Shenzhen Wall

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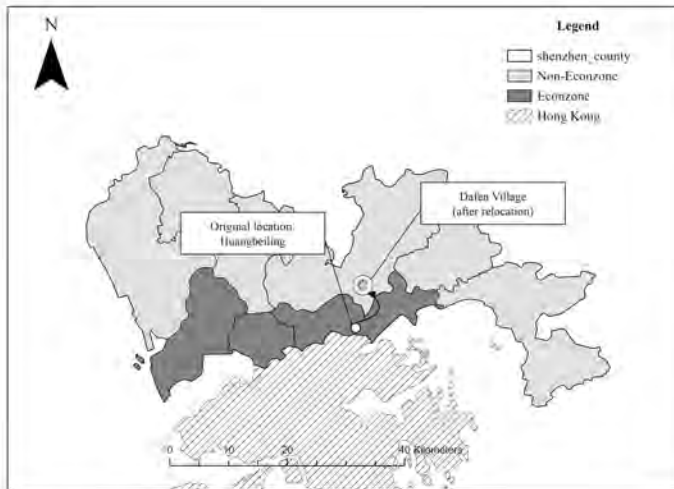
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China Economic Summer Institute, August 14, 2026

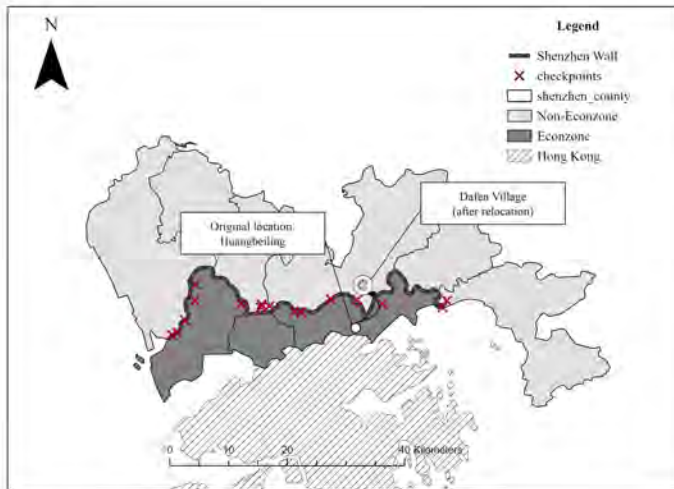
China's Van Goghs



Motivating Example: Oil-painting Industry



Motivating Example: Oil-painting Industry



A Wall Almost Forgotten (*ErXianGuan*)



(a) Wire fences



(b) Patrolling soldiers



(c) Border Pass



(d) Inspection

Motivation

- Barriers to the movement of people have profound effects on the spatial distribution of population and economic activity.
 - e.g., borders and mobility restrictions
- The postwar division of Germany caused substantial population decline in cities near the East-West border (Redding & Sturm, 2008).
- The U.S.-Mexico border wall redirected migration flows with consequent effects on local labor markets (Allen, Dobbin, & Morten, 2018).
- However, less is known about how restrictions on labor mobility within cities shape firm location, commuting patterns, and welfare.

This Paper

Research question: How did the labor mobility restriction shape the long-run spatial distribution of economic activity?

- A unique historical setting: the Shenzhen Wall
 - a physical border separating the SEZ and the rest of the city for nearly three decades
 - tax advantage inside, and commuting cost increase across the wall
- Reduced-form evidence
 - firm entry, firm stock, and employment size across the Wall
 - commuting flows and industry heterogeneity to identify labor-supply channel
- Quantitative spatial model
 - a model of bilateral commuting frictions, labor market access, and agglomeration
 - counterfactual: what would today's spatial distribution of economic activity look like if the Wall still existed?

Preview of findings

- Labor market access is more favorable outside the SEZ.
 - significantly more entrants, more incumbents, larger employment size just outside the Wall
 - The boundary effect persisted long after the Wall ceased to function after 2010, consistent with durable agglomeration forces.
- Mechanism: the Wall raised commuting costs across zones.
 - Even today, cross-zone commuting is much lower than within-zone commuting.
 - a larger discontinuity in firm entry for labor-intensive industries
- Counterfactual: the commuting-cost wedge
 - net population outflows from the economy,
 - cross-wall commuting declines substantially, with flows from non-SEZ to SEZ experiencing the largest decline
 - workplace employment declines in both zones, with a larger decline inside
 - wages increase more inside the SEZ
 - the losses are amplified with endogenous agglomeration forces

Related Literature

- **Labor mobility frictions:** Redding and Sturm (2008), Ahlfeldt et al. (2015), Allen et al. (2024), Tombe and Zhu (2019).

[This paper](#): an internal physical border that raised commuting costs within a city.

- **Place-based policies:** Busso et al. (2013), Kline and Moretti (2014), Wang (2013), Lu et al. (2019), Zheng et al. (2017), Gaubert et al. (2025).

[This paper](#): long-run spatial effects of an SEZ through its boundary and buffer zone.

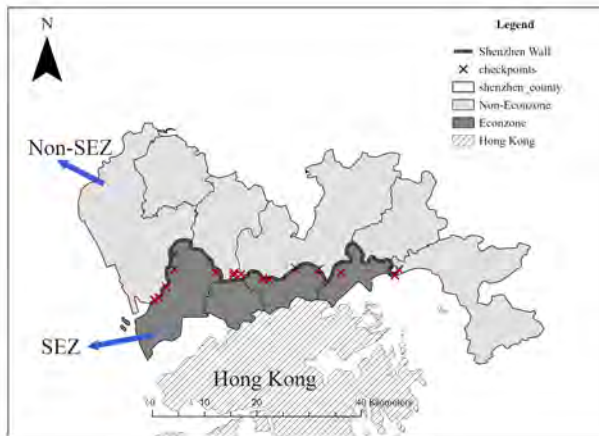
- **Quantitative spatial models:** Allen and Arkolakis (2014), Monte et al. (2018), Heblich et al. (2020), Severen (2023), Tsivanidis (2026).

[This paper](#): an open-city model with bilateral commuting frictions.

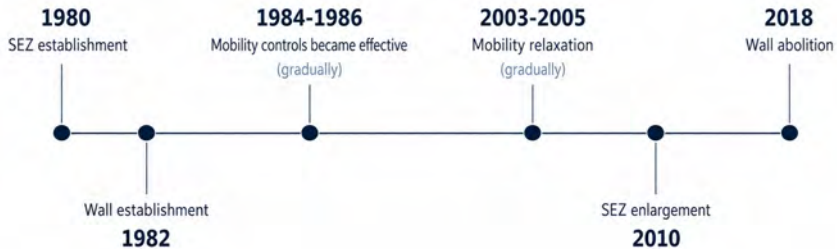
- **Chinese economy:** reform and opening up, international trade

[This paper](#): Shenzhen's takeoff relied on early accumulation in processing-trade industries, but the SEZ preferential regime came with spatial costs.

Institutional Setting



Institutional timeline



Data ($500m \times 500m$ Grid-level)

- **Economic census data (2004, 2008, 2013)**
 - employment size, firm stock
- **Firm registration data (1970-2020)**
 - firm name, address, industry code, registration date, etc.
- **Commuting data (Nov 2024)**
- **Supportive data**
 - Land use: *LUCC* (1980-2023), *CLCD* (1990-2019)
 - Building height (1975-2020): *GHS*
 - Floorspace price
 - Commercial rent (2020-2025) from *Loulan*
 - Residential guideline rent (2000-2016, 2022) by *Shenzhen Municipal Housing and Construction Bureau*
 - Firm-level transactions: Custom (2000-2016), Value-added Tax (2014-2018)

Summary statistics

Table: Summary Statistics

Variable Name	N	Mean	SD	Min	Max
Firm entrants, stock and performance					
<i>firm_entry</i>	317,100	16.190	79.167	0	5,418
<i>emp</i>	22,650	381.147	1,476.340	0	79,250
<i>firm_stock</i>	22,650	14.351	63.792	0	2,248
<i>ExportSales</i>	18,141	0.368	3.859	0	215.508
<i>TotProfit</i>	18,141	0.198	2.835	-13.596	164.908
<i>NetProfit</i>	18,141	0.173	2.416	-13.839	154.156
<i>OptCashoutflow</i>	18,141	1.910	29.744	-4.007	2,334.136
<i>distance</i>	317,100	7,363.691	7,720.782	-9,750	29,560

Summary statistics

Table: Summary Statistics

Variable Name	N	Mean	SD	Min	Max
Grid-level variables					
<i>Non_SEZ</i>	317,100	0.799	0.401	0	1
<i>Terrain</i>	317,100	74.122	64.953	0	403
$\bar{L}$	1,711	667,345.792	659,411.968	0	3,980,302.750
r_R	1,711	54.460	24.284	27.345	216.980
r_M	1,711	51.901	13.663	27.901	119.146
Commuting variables					
<i>TravelTime</i>	2,927,521	57.158	24.905	0	187.533
<i>flow</i>	2,927,521	1.605	19.715	0	3,141
<i>CrossWall</i>	2,927,521	0.323	0.467	0	1

Empirical Design

Spatial RDD. $500m \times 500m$ grid-level; in total 7,550 grids.

$$\text{Log}(\text{Outcome}_{it}) = \alpha + \beta \text{Non_SEZ}_i + f(\text{Distance}_i) + \text{Slope}_i + \tau_t + \varepsilon_{it}$$

where:

- Outcome_{it} : outcomes in grid i and year t , including Num_Emp_{it} (employment), Firm_Stock (firm stock) and Num_firm_{it} (firm entry).
- Non_SEZ_i : indicator equal to 1 if grid i lies outside the SEZ
- Distance_i : running variable, positive in the non-SEZ and negative in the SEZ
- $f(\text{Distance}_i)$: polynomial in Distance_i (linear, quadratic, and cubic specifications)
- Slope_i : land slope at grid i .
- τ_t : year fixed effects
- Standard errors are clustered at the grid level

Effects on Employment Size

Table: Spatial Discontinuity in the Employment Size

<i>Dep.Var.: log (#emp)</i>			
	(1) 2004	(2) 2008	(3) 2013
<i>Non_SEZ</i>	0.656*** (0.197)	0.649*** (0.162)	0.784*** (0.205)
Baseline controls	Yes	Yes	Yes
Bandwidth restriction	No	No	No
<i>N</i>	7,550	7,550	7,550

NOTES: The data are sourced from the *Economic Census*, which gives information about # of employment at the firm level and is available in 2004, 2008, and 2013. The specification is the same as the baseline model. The regression is run without bandwidth on cross-sectional data. Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Effects on Firm Stock

Table: Spatial Discontinuity in the Firm Stock

Dep.Var.: log (#firm stock)			
	(1) 2004	(2) 2008	(3) 2013
<i>Non_SEZ</i>	0.185*** (0.061)	0.406*** (0.079)	0.580*** (0.121)
Baseline controls	Yes	Yes	Yes
Bandwidth restriction	No	No	No
<i>N</i>	7,550	7,550	7,550

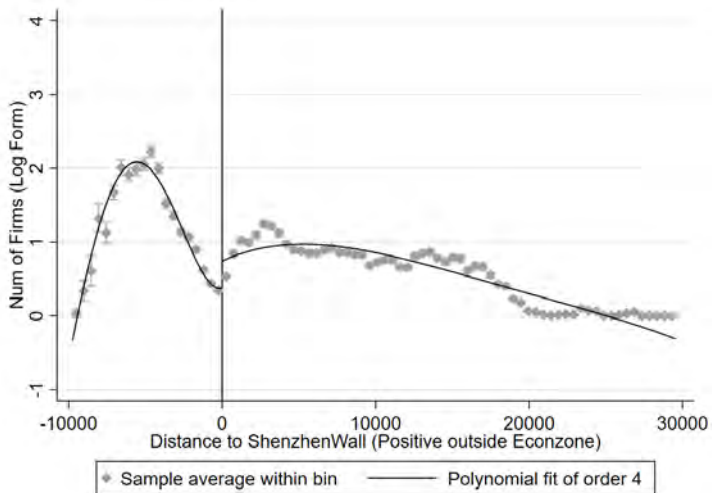
NOTES: The data are sourced from the *Economic Census*, which provides firm-level information on active enterprises for the years 2004, 2008, and 2013. The 2004 dataset covers the universe of manufacturing firms, whereas the 2008 and 2013 datasets are cross-industry samples. The specification is the same as the baseline model. The regression is run without bandwidth on cross-sectional data. Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Robustness Check

The discontinuity in employment is **NOT** explained by:

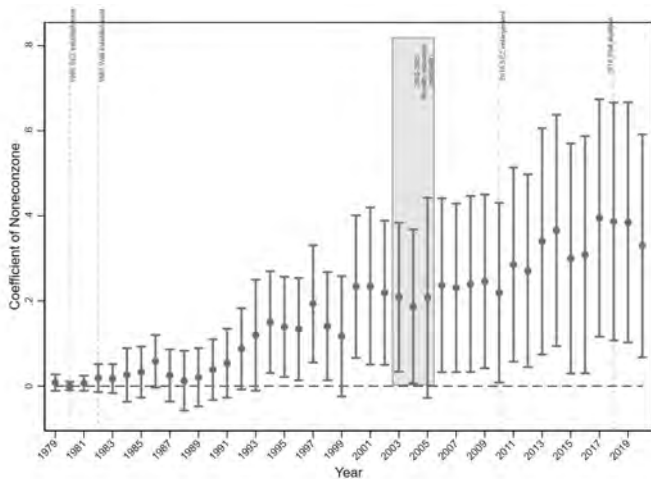
- **Terrain**: results hold in the non-mountainous subsample (Left Shenzhen) [▶ go](#)
- **Polynomial order** [▶ go](#)
- **Land-use constraints**: urban built-up land, rural residential land, and suburban industrial land [▶ go](#)
- **Administrative borders**: no analogous jump along county borders within or outside the SEZ [▶ go](#)
- **Policy restrictions on firm entry**: the discontinuity is already present in processing trade before 1995 [▶ go](#)
- **Falsification test**: no significant discontinuity at a placebo boundary shifted 2 km north or south of the actual Wall [▶ go](#)

Effects on Firm Entry (1970-2020)



- Each bin is 500 m. The jump in the number of entrants at the wall ≈ 5 .

Dynamic Patterns (1970-2020)



- The discontinuity persists well beyond 2010 and into the post-removal period, suggesting **agglomeration forces** sustain the spatial pattern.

Industry Heterogeneity

Table: Heterogeneous Effects on Labor- and Capital-Intensive Industries

<i>Dep.Var.: log (#firm entry)</i>		
	(1)	(2)
	Labor-intensive	Capital-intensive
<i>Non_SEZ</i>	0.066*** (0.025)	0.034** (0.016)
Baseline controls	Yes	Yes
Bandwidth restriction	Yes	Yes
<i>N</i>	198,072	198,072

NOTES: Data source is firm registration data. The discontinuity design is run at a bandwidth of 10 *km*. Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

- The non-SEZ premium is larger for labor-intensive industries, consistent with the hypothesis that the Wall primarily operated through **restricted labor supply** rather than product-market or capital channels.

Commuting Frictions

Gravity-style specification. The commuting-flow equation takes the form:

$$\mathbb{E}[Flow_{ij}] = \exp\left(\nu TravelTime_{ij} + \xi \mathbf{1}\{CrossWall_{ij} = 1\} + \lambda_i + \delta_j\right)$$

where:

- $TravelTime_{ij}$: commuting time between location pair (i, j)
- $\mathbf{1}\{CrossWall_{ij} = 1\}$: dummy var, 1 if $\{i, j\}$ belong to different zones

Commuting Frictions

Table: Commuting Across the Wall (Nov 2024)

	(1) ols	(2) ppml	(3) ols	(4) ppml
TravelTime	-0.0090*** (0.0003)	-0.1348*** (0.0018)	-0.0087*** (0.0003)	-0.1341*** (0.0019)
CrossWall			-0.1435*** (0.0128)	-0.0708* (0.0404)
Specification	OLS	PPML	OLS	PPML
Origin Grid FE	Yes	Yes	Yes	Yes
Dest Grid FE	Yes	Yes	Yes	Yes
N	2,927,521	2,166,640	2,927,521	2,166,640

NOTES: Data are drawn from *Baidu Map*. The dependent variable in Column (1) and (3) are # of flows in logarithmic level, and those in Column (2) and (4) are # of flows in absolute level. Each regression is run at the $1,000m \times 1,000m$ grid-pair level. Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

- The negative CrossWall coefficient implies an additional commuting barrier beyond travel time.
- The coefficient -0.1348 is recovered from the PPML estimate of travel-time elasticity; this directly informs model calibration.
 - Following Ahlfeldt et al. (2015), we get $\epsilon = 5.87$, $\kappa = 0.0228$.

Further Discussion

Additional firm-level evidence helps distinguish commuting frictions from performance sorting

- **Comparable Financials:** firm export, profit, and cash flow remain indistinguishable regardless of location [▶ go](#)

Empirical Takeaways for the Model

- ① The Wall shifted firm entry, firm stock, employment, and commuting flows across space.
- ② Industry heterogeneity points to labor-supply restrictions as a central mechanism.
- ③ The dynamic firm-entry pattern suggests persistence beyond the policy episode, motivating agglomeration in the model.
- ④ The commuting evidence naturally maps into a gravity structure with bilateral mobility frictions.
- ⑤ We therefore use a quantitative spatial model to ask how today's spatial equilibrium would differ if the Wall still existed.

Workers

The indirect utility for a worker living in i and working in j is

$$V_{ijo} = B_{ij} \frac{w_j}{d_{ij} r_{Ri}^{1-\alpha}} \nu_{ijo}$$

- $B_{ij} = \mathcal{B}_i \mathcal{B}_j \mathcal{B}_{ij}$: bilateral amenity term.
 - Agglomeration effect: $\mathcal{B}_i = b_i \Omega_i^{\mu_U} = b_i \left[\sum_{r=1}^S e^{-\rho \tau_{ir}} \left(\frac{H_{Rr}}{K_r} \right) \right]^{\mu_U}$
- w_j : workplace wage; r_R : residential floorspace price.
- ν_{ijo} : idiosyncratic preference, Fréchet distributed with shape parameter ϵ , i.e., $F(\nu_{ijo}) = \exp\{-\nu_{ijo}^{-\epsilon}\}$.
- $d_{ij} = \exp\{\kappa \tau_{ij}\}$: commuting cost, where κ converts travel time into utility cost.
- Workers transfer earnings outside Shenzhen, so the model abstracts from local consumption demand.

Workers

The residence–workplace choice probability has a gravity form:

$$\pi_{ij} = \frac{(B_{ij}w_j)^\epsilon \left(d_{ij}r_{Ri}^{1-\alpha}\right)^{-\epsilon}}{\sum_k \sum_\ell (B_{k\ell}w_\ell)^\epsilon \left(d_{k\ell}r_{Rk}^{1-\alpha}\right)^{-\epsilon}}$$

Conditioning on residence or workplace yields residential and firm commuter market access (CMA):

$$RCMA_i \equiv \sum_{j=1}^S (B_{ij}w_j/d_{ij})^\epsilon, \quad FCMA_j \equiv \sum_{i=1}^S \left(B_{ij}r_{Ri}^{\alpha-1}/d_{ij}\right)^\epsilon$$

$$H_{Mj} = \sum_{i=1}^S \frac{(B_{ij}w_j/d_{ij})^\epsilon}{RCMA_i} H_{Ri}, \quad H_{Ri} = \sum_{j=1}^S \frac{(B_{ij}r_{Ri}^{\alpha-1}/d_{ij})^\epsilon}{FCMA_j} H_{Mj}$$

- H_{Mj} is workplace employment in location j ; H_{Ri} is residential population in location i .

Free mobility equalizes the expected utility from moving to the city with the reservation utility level of the broader economy ($\bar{U}$):

$$\bar{U} = \mathbb{E}(U) = \Gamma(\epsilon) \left[\sum_{k \in \mathbb{N}} \sum_{\ell \in \mathbb{N}} (B_{k\ell} w_{\ell})^{\epsilon} (d_{k\ell} r_{Rk}^{1-\alpha})^{-\epsilon} \right]^{\frac{1}{\epsilon}}$$

Firms

Production in the workplace j follows a Cobb-Douglas technology:

$$y_j = A_j \left(\frac{H_{Mj}}{\beta} \right)^\beta \left(\frac{L_{Mj}}{1-\beta} \right)^{1-\beta}.$$

Under zero profits,

$$\mathbb{A}_j = w_j^\beta (r_{Mj})^{1-\beta}, \quad \mathbb{A}_j = \frac{A_j p}{\tau_{0j}}.$$

- **Processing trade:** all goods are **sold to overseas markets** at a fixed price (p), subject to location-specific trade cost (τ_{0j}).
- **Agglomeration effect:** $\mathbb{A}_j = a_j \Upsilon_j^{\mu_A} = a_j \left[\sum_{s=1}^S e^{-\delta \tau_{js}} \left(\frac{H_{Ms}}{K_s} \right) \right]^{\mu_A}$
- **Firms earn zero profits + free entry.** [▶ Alternative Setting](#)

Absentee Landlords

Absentee landlords supply total floorspace inelastically and allocate it across residential and industrial use. No-arbitrage between the two uses after the tax-equivalent land-use regulation implies that the share of floor space used commercially (θ_i) is

$$\begin{aligned}\theta_i &= 1 && \text{if } r_{Mi} > \xi_i r_{Ri}, \\ \theta_i &\in [0, 1] && \text{if } r_{Mi} = \xi_i r_{Ri}, \\ \theta_i &= 0 && \text{if } r_{Mi} < \xi_i r_{Ri}\end{aligned}$$

where ξ_i captures the land-use regulation that restricts commercial relative to residential use.

Define Model Equilibrium

Equilibrium definition Given the parameters $\{\alpha, \beta, \kappa, \epsilon\}$, the reservation utility in the wider economy $\bar{U}$, and the vectors of location characteristics $\{d_{ij}, A_j, B_{ni}, \xi, \tau_{0j}\}$, the equilibrium is a set of allocations, prices, and total population $\{\pi_M, \pi_R, r_M, r_R, w, \theta, H_{\mathbb{N}}\}$ satisfying:

- 1 (π_M, π_R) Worker location choices are consistent with residential and workplace distributions.
- 2 (w) Firms maximize profits and earn zero profits.
- 3 (r_M, r_R) Floorspace prices satisfy no-arbitrage across uses.
- 4 (θ) Floorspace markets clear.
- 5 $(H_{\mathbb{N}})$ Expected utility from moving to the city equals the reservation utility in the wider economy $\bar{U}$.

Calibration and Empirical Inputs

Parameter	Definition	Value	Notes
$1 - \alpha$	Share of workers' expenditure on housing	0.20	SZ Stat. Yearbook
β	Share of firms' expenditure on labor	0.55	GD Stat. Yearbook
ϵ	Shape parameter	5.87	Wage-based calibration
κ	Size of commuting costs	0.0228	Wage-based calibration
μ_A	Workplace agglomeration	0.07	Ahlfeldt et al. (2015)
μ_U	Residential agglomeration	0.15	Ahlfeldt et al. (2015)
ρ	spatial decay of amenity externalities	0.75	Ahlfeldt et al. (2015)
δ	Spatial decay of productivity externalities	0.36	Ahlfeldt et al. (2015)

Counterfactual Analysis

- **Question.** If the Wall still existed today, how would Shenzhen's spatial distribution of residence, workplace employment, and commuting differ? ($\hat{d}_{ij} = \exp\{\kappa \Delta \tau_{ij}\}$)
 - detour in route and time delay at checkpoints
 - **Bilateral friction:** commuting time τ_{ij} at checkpoint m :

$$\Delta \tau_{ij} = \begin{cases} t_{im(i,j)} + t_{m(i,j)j} - t_{ij} + t_{m0}, & \text{if } i \text{ and } j \text{ belong to different zones,} \\ 0, & \text{if } i \text{ and } j \text{ belong to the same zone.} \end{cases}$$

where $t_{m0} = 0/10/20/30$ denotes the inspection delay. ▶ delay time

- w/ or w/o agglomeration effect

Open-City Counterfactual

Table: Total Population Ratio ($\widehat{H}_{\mathbb{N}}$)

	Delay 0	Delay 10	Delay 20	Delay 30
With agglomeration ($\mu_A = 0.07, \mu_U = 0.15$)	0.950	0.930	0.925	0.923
Without agglomeration ($\mu_A = 0, \mu_U = 0$)	0.968	0.955	0.951	0.950

Notes: Entries are total population in millions. In the open-city fixed-utility closure, utility is held at the 2024 baseline level and total population adjusts endogenously. The observed 2024 baseline population is 17.990 million.

Open-City Counterfactual

Table: Counterfactual Population Reallocation Relative to the 2024 Baseline

	Delay 0	Delay 10	Delay 20	Delay 30
<i>Panel A. With agglomeration ($\mu_A = 0.07, \mu_U = 0.15$)</i>				
Cross-zone commuting	-7.71	-11.05	-12.07	-12.35
SEZ $\rightarrow$ non-SEZ	-1.91	-2.59	-2.77	-2.81
non-SEZ $\rightarrow$ SEZ	-5.79	-8.46	-9.30	-9.54
Within-zone commuting	2.67	4.06	4.53	4.67
SEZ $\rightarrow$ SEZ	2.31	3.55	3.97	4.09
non-SEZ $\rightarrow$ non-SEZ	0.36	0.51	0.56	0.58
Net exit	5.04	6.99	7.54	7.69
<i>Panel B. Without agglomeration ($\mu_A = 0, \mu_U = 0$)</i>				
Cross-zone commuting	-7.34	-10.72	-11.81	-12.13
SEZ $\rightarrow$ non-SEZ	-1.96	-2.65	-2.83	-2.88
non-SEZ $\rightarrow$ SEZ	-5.38	-8.07	-8.98	-9.25
Within-zone commuting	4.17	6.23	6.94	7.15
SEZ $\rightarrow$ SEZ	2.43	3.70	4.15	4.28
non-SEZ $\rightarrow$ non-SEZ	1.74	2.52	2.79	2.87
Net exit	3.17	4.49	4.88	4.99

Notes: The total population ratio is the counterfactual total population divided by the observed 2024 baseline of 17.99 million. All other entries are percentage-point changes in each flow, measured as the change in that flow divided by the 2024 baseline population. Cross-zone commuting pools the SEZ $\rightarrow$ non-SEZ and non-SEZ $\rightarrow$ SEZ flows, and within-zone commuting pools the SEZ $\rightarrow$ SEZ and non-SEZ $\rightarrow$ non-SEZ flows, each decomposed by direction in the indented rows.

Open-City Counterfactual

Table: Employment ($\hat{H}$), Wage ($\hat{w}$) and Rent Ratio ($\hat{r}$) under Agglomeration

	Delay 0	Delay 10	Delay 20	Delay 30
<i>Panel A: SEZ</i>				
Residential employment	1.028	1.060	1.072	1.076
Workplace employment	0.895	0.853	0.840	0.837
Wages	1.046	1.069	1.082	1.091
Residential rents	1.024	1.059	1.072	1.076
Industrial rents	0.924	0.897	0.888	0.885
<i>Panel B: Non-SEZ</i>				
Residential employment	0.935	0.905	0.896	0.893
Workplace employment	0.982	0.977	0.976	0.975
Wages	1.008	1.012	1.014	1.014
Residential rents	0.948	0.928	0.922	0.920
Industrial rents	0.985	0.981	0.980	0.980

Notes: Employment rows report zone-level aggregate hats relative to the 2024 baseline, computed as the ratio of the zone total in the counterfactual to the zone total at baseline. Wage and rent rows report zone-level averages of location-specific hats, weighted by each location's 2024 baseline price. Delay 0 is the detour-time counterfactual without additional delay, and Delay 10, 20, and 30 additionally impose 10-, 20-, and 30-minute delays on cross-zone commuting pairs.

Conclusion & Next Step

Conclusion

- The Shenzhen Wall created persistent commuting frictions with long-run spatial effects on firm entry, firm stock, and employment.
- The reduced-form evidence points to labor-supply restrictions, rather than productivity differences, as the central mechanism.
- The structural model translates this commuting wedge into an open-city counterfactual reallocation of jobs, residents, and commuting flows.
- Agglomeration amplifies these long-run spatial effects.

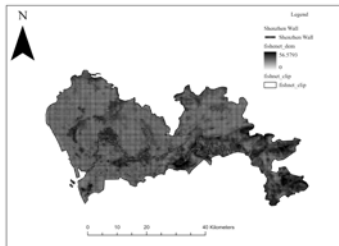
Next Step

- Firm side model ▶ Alternative Setting
- Discipline the dynamic interpretation using the yearly pattern of firm entry.
- Use a Heblich-style historical population inference to estimate agglomeration at finer geographic scale. ▶ feasibility

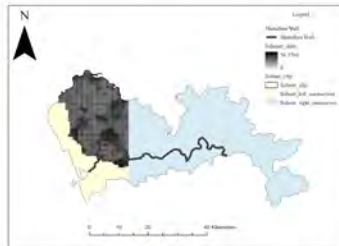
Table: Alternative Polynomial Specifications

<i>Dep.Var.: log (#emp)</i>			
	(1)	(2)	(3)
	1st order	2nd order	3rd order (baseline)
<i>Non_SEZ</i>	0.312*** (0.111)	1.118*** (0.131)	0.696*** (0.149)
<i>N</i>	22,650	22,650	22,650

Notes: Column (3) presents our baseline specification using a third-order polynomial. Columns (1) and (2) report alternative specifications using first- and second-order polynomials, respectively.



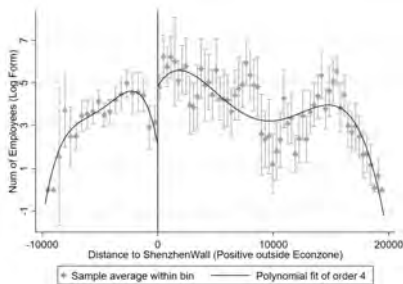
(e) DEM



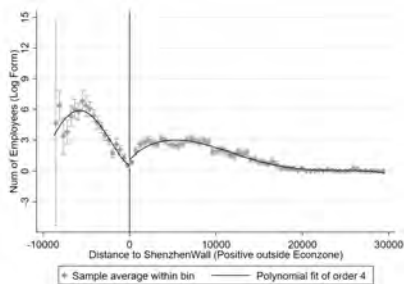
(f) Western and Eastern Subsample

Figure: (1/3) Defining Western vs. Eastern Shenzhen

Robustness Check ► Robustness Check



(a) Western Shenzhen: w/o mountains

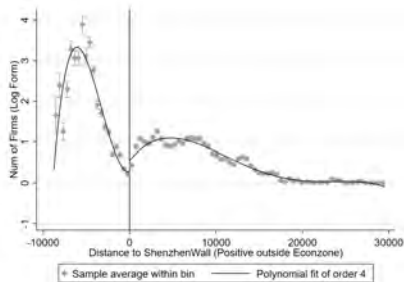
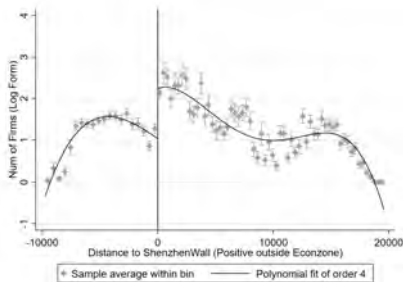


(b) Eastern Shenzhen: w/ mountains

Figure: (2/3) Spatial Discontinuity in Employment Along the Wall

Robustness Check

► Robustness Check



(a) Western Shenzhen: w/o mountains

(b) Eastern Shenzhen: w/ mountains

Figure: (3/3) Spatial Discontinuity in Firm Entry Along the Wall

Table: Cross-Administrative-Boundary Effects

Panel A: Inside SEZ administrative boundaries

Dep.Var.: log (#emp)

	(1)	(2)	(3)
	Futian–Luohu	Luohu–Yantian	Nanshan–Futian
<i>Treatment</i>	-0.875 (0.617)	0.243 (0.526)	-1.265** (0.520)
<i>N</i>	990	720	1,224

Panel B: Outside SEZ administrative boundaries

Dep.Var.: log (#emp)

	(1)	(2)	(3)	(4)	(5)
	Baoan–Guangming	Baoan–Longhua	Guangming–Longhua	Longhua–Longgang	Longhua–Pingshan
<i>Treatment</i>	-0.303 (0.265)	-0.067 (0.473)	-0.106 (0.322)	-0.232 (0.401)	-0.140 (0.209)
<i>N</i>	3,501	1,185	1,299	2,265	3,855

Table: Landuse type

Dep.Var.: Share of land use

	(1)	(2)	(3)
	Urban built-up land	Rural residential land	suburban industrial land
<i>Non_SEZ</i>	0.032 (0.023)	0.004 (0.003)	-0.012* (0.006)
<i>N</i>	42,444	42,444	42,444

Notes: Data are sourced from the 30-meter resolution Land Use and Cover Change (LUCC) dataset. The three columns report urban built-up land, rural residential land, and other construction land, respectively.

Robustness Check

► Robustness Check

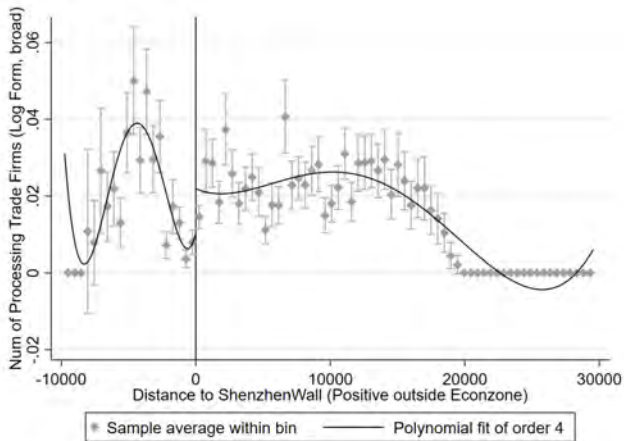


Figure: Spatial discontinuity for processing trade registered before 1995

Table: Falsification Test

<i>Dep.Var.: log (#emp)</i>		
	(1)	(2)
	Shift 2km North	Shift 2km South
<i>Falsi_Non_SEZ</i>	0.216 (0.222)	-0.376 (0.279)
Baseline controls	Yes	Yes
Bandwidth restriction	Yes	Yes
<i>N</i>	14,148	14,148

Notes: Data are sourced from registration data. Columns (1) and (2) present the estimated discontinuities in firm counts across counterfactual boundaries shifted 2,000 meters to the north and south, respectively.

Table: Spatial Discontinuity in Firm Performance

	ExportSales	TotProfit	NetProfit	OptCashOutflow
<i>Non_SEZ</i>	0.008 (0.012)	-0.007 (0.006)	-0.007 (0.006)	0.004 (0.024)
Baseline controls	Yes	Yes	Yes	Yes
Bandwidth restriction	Yes	Yes	Yes	Yes
<i>N</i>	28,296	28,296	28,296	28,296

Notes: Our data are sourced from the Tax Survey data.

Firm Each firm k produces one variety in grid j with idiosyncratic productivity $A_j^k = A_j^0 \varepsilon^k$, $\varepsilon^k \sim \text{Pareto}(\theta)$.

Entrants pay a sunk, zone-specific entry cost $f_{E,z(j)} c_j$. Incumbents pay a deductible fixed cost $f_j c_j$ and choose the sales price. The total profit of firm k in grid j is

$$\Pi_j(\varepsilon^k) = (1 - \bar{t}_{z(j)}) \left[\max_{p_{*j}^k} p_{*j}^k q_{*j}^k - \frac{c_j \tau_{0j}}{A_j^0 \varepsilon^k} q_{*j}^k - f_j c_j \right] - f_{E,z(j)} c_j$$

Outside Market. The outside economy is a consumer spending Y on Shenzhen varieties in nested CES form. Across grids the elasticity is η , within each grid it is σ , with $\sigma > \eta > 1$.

Equilibrium Number of Firms. Grid-level revenue, free entry, and the zero-profit condition jointly pin down the equilibrium number of firms:

$$M_j = C \left[\frac{1 - \bar{t}_{z(j)}}{f_{E,z(j)}} \right]^{\frac{(\eta-1)(\sigma-1)}{\theta(\sigma-\eta)}} \left(\frac{A_j^0}{\tau_{0j}} \right)^{\frac{(\eta-1)(\sigma-1)}{\sigma-\eta}} c_j^{-\frac{\eta(\sigma-1)}{\sigma-\eta}} f_j^{-\frac{\sigma-1}{\sigma-\eta} \left(1 - \frac{\eta-1}{\theta} \right)} \left[P^{\eta-1} Y \right]$$

Delay time ▶ counterfactual

记者日前来到梅林关采访。早上8时，四面八方汇集而来的车流涌入梅林关，数十辆公交车停在站场内，远处南坪快速路转入彩田路的车辆也堵在立交桥上不能动弹。梅林关进关方向所有的车道被挤得满满当当的，车辆挪动速度非常缓慢，经过公交车接驳站的大巴，从进站到出站，大约要花15分钟。 *Buses passing through the transfer terminal took approximately 15 minutes just to enter and exit the station.*

记者数了一下，经过梅林关的公交车有29条线路，还有27条线路的公交车以梅林关为始发站。梅林关口有一个广场，将从梅林关始发公交车和途经公交车分开成两个场站停靠，站台总共有12个。进入梅林关的车道有十多条，可进入彩田路后就变成4车道，
加上从南坪快速、新区大道涌来的车辆，使梅林关拥堵更为严重。车龙绵延数公里，一眼望不到头。 *Although more than ten lanes led into the Meilin Checkpoint, they narrowed to only four lanes upon reaching Caitian Road. Traffic arriving from Nanping Expressway and Xinqu Avenue further intensified the bottleneck.*

根据测试记录，2003年梅林关日均进关车辆已达8万辆，梅观路关口段、彩田路北段高峰期每小时单向车流量为5000辆，堵塞时有发生。2006年11月27日，市交管局现场测试表明，梅林关日交通流量为双向26万辆；在16:00-20:00，双向交通流量为14800车/小时；交通拥堵点主要位于出关方向民乐跨线桥南侧，一般拥堵时间约为25分钟， *Congestion typically caused delays of approximately 25 minutes, with vehicle queues extending about 800 metres.*

Figure: 2006 Meilin Checkpoint Traffic Jam (from People's Daily Online)

Recovering historical workplace employment

Extends the spirit of Heblich et al. (2020), but uses **floorspace stock**, **residential population**, and **floorspace prices**. For each grid n in the target year τ , we observe total floorspace stock L_n^τ . We impose:

$$L_n^\tau = L_{n,\text{res}}^\tau + L_{n,\text{ind}}^\tau = \frac{(1 - \alpha) \mathbb{E}(w_j | n)^\tau H_{Rn}^\tau}{r_{Rn}^\tau} + \frac{1 - \beta}{\beta} \frac{w_n^\tau H_{Mn}^\tau}{r_{Mn}^\tau}$$

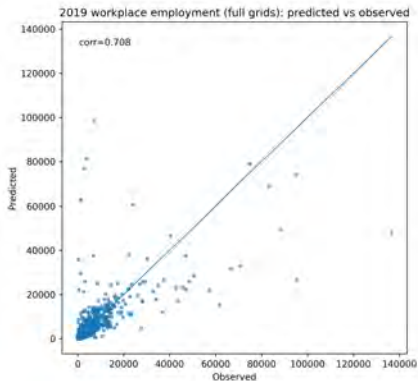
$$L_i \hat{L}_i = (1 - \alpha) \cdot \hat{H}_{Ri} H_{Ri} \cdot \hat{r}_{Ri}^{-1} r_{Ri}^{-1} \sum_{j=1}^s \frac{\pi_{ji|i} (\hat{B}_{ji} \hat{w}_j)^\epsilon \hat{d}_{ij}^{-\epsilon}}{\sum_{\ell} \pi_{\ell i|i} (\hat{B}_{\ell i} \hat{w}_\ell)^\epsilon \hat{d}_{i\ell}^{-\epsilon}} w_j \hat{w}_j$$

$$+ \frac{1 - \beta}{\beta} \cdot \hat{w}_i w_i \cdot \hat{r}_{Mi}^{-1} r_{Mi}^{-1} \sum_{n=1}^s \frac{\pi_{ni|i} (\hat{B}_{ni} \hat{w}_i)^\epsilon \hat{d}_{ni}^{-\epsilon}}{\sum_{\ell} \pi_{n\ell|n} (\hat{B}_{n\ell} \hat{w}_\ell)^\epsilon \hat{d}_{n\ell}^{-\epsilon}} \hat{H}_{Rn} H_{Rn}$$

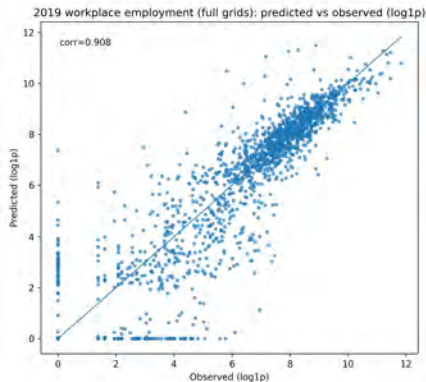
$\Rightarrow$ Solve for wage (w) and change in wage level ($\hat{w}$), and then figure out the workplace population (H_M). [▶ Conclusion](#) [▶ Fitness](#)

Recover historical workplace population ▶ Conclusion

Data Source: Commuting data (2019 & 2024)



(a) Level (corr ≈ 0.708)



(b) $\log(1 + \cdot)$ (corr ≈ 0.908)

Figure: 2019 workplace employment (full grids): predicted vs observed.

Border Effect (VAT)

Small scale of transaction across the wall.

Table: Trade friction across Shenzhen Wall

	(1) trans_amount	(2) log_trans_amount
CrossWall	-783.889*** (31.696)	-0.017*** (0.001)
geodist	-86.334*** (1.284)	
log_geodist		-0.052*** (0.000)
Constant	48020.145*** (21.363)	9.540*** (0.001)
SellerFirm*Year FE	YES	YES
BuyerFirm*Year FE	YES	YES
Month FE	YES	YES
Observations	45,265,150	45,075,803
R ²	0.376	0.496